Experiments for industrial exploration: testing a car sharing system

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Abstract

In June 2012, Renault turned Saint-Quentin-en-Yvelines, a town on the outskirts of Paris, into a experimentation and demonstration laboratory. The company introduced a fleet of 50 electric cars as part of a car sharing system without fixed stations called Twizy Way. This scheme falls in line with the manufacturer's development strategy for the electric car market. According to one of the main project managers, this program is a "first step into new mobilities". In this paper will try and present what we consider a quite poorly documented aspect of the STS debate on experimenting and related to boundary work for the experiment. We will therefore take into account the ontological work the experiment will produce as well as its demonstrative ability and the way it intertwines knowledge, as part of this boundary drawing within the framework of the experiment itself. We do not aim at challenging the countless works focusing on the performative effects of experiments, we rather reflect on the fact that its limits are often taken for granted and analyse moments of doubt and negotiation concerning what is considered experimental or not. We do not plan on using definition for any social, technical, economic, ecological, urban or political element involved in the experiment and will consider them, on the contrary, as the temporary and negotiated result of this very operation of laboratorisation. That is why we will speak of a form of flexible laboratorisation affected by doubt and constant reorganisation of the elements making up, overflowing and interfering with the experiment.

Keywords

Electric cars sharing system, experimentation, urban laboratory, industrial exploration, Smart Cities

Introduction

In June 2012, Renault turned Saint-Quentin-en-Yvelines, a town on the outskirts of Paris, into a test and demonstration laboratory. The company introduced a fleet of 50 electric cars as part of a car sharing system without fixed stations called *Twizy Way*. This scheme falls in line with the manufacturer's development strategy for the electric car market[1]. According to one of the main project managers, this program is a "first step into new mobilities" and the emerging *car sharing* market through an "exploration process".

How can we describe the "exploration" the manufacturer undertook for this project? This paper will take Twizy Way as a typical example of an industrial innovation mode based on experimenting. The concept of experiment is at the heart of this study because it relates to instrumented operations leading to demonstrations having a certain degree of publicisation and therefore enabling to deal with technical and social uncertainties. Experimental testing is an old trick for companies (e.g., the use of prototypes in the industrial innovation process). Let us resort to it once more in order to underline an experimental system characterized by the questioning of limits within the experiment itself. When a company puts an electric car sharing scheme to the test "in real life", it needs to define the spatial, economic, technical and social boundaries of the project to determine the geographical area of the experiment site, the vehicle types, the intended users and the economic model it plans to try out. Yet, we will demonstrate that Twizy Way is characterised by a dramatic redefinition of those boundaries. Highlighting those redefinitions will enable us to characterise more precisely the experimental system for industrial innovation and bring out the part exploration devices for industrial innovation play in the development of markets and the establishment of public policies. We will thus see how the Twizy Way experiment is an opportunity for Renault to explore a technical system as well as a chance for us, as analysts, to reflect on the definition of market objects as product (here vehicles) or service (e.g., car sharing systems), and on the distribution of responsibilities between public and private initiatives.

In the past few years, a number of works adopting a "laboratory perspective" (Doing, 2008) have turned to non-scientific activities, thereby bringing forth a growing interest in a process that could be described as the "exteriorisation" of the laboratory (Latour, 2001). Works have focused on "field testing" or "in vivo testing" (Callon, Lascoumes, Barthe, 2001)[2], which imply greater levels of uncertainty and risk, because the "real life" experimental protocols are not as stable as confined ones, and more complex to manage (Callon, Lascoumes, Barthe, 2001). As a matter of fact, today, the term experiment is used in the study of forms of governance of a nation (Mitchell, 2005) and of economic processes (Muniesa and Callon, 2007); in the analysis of urban processes (Gieryn, 2006; Tironi, 2014) and in the political field (Millo and Lezaun, 2006; Marres, 2012; Laurent, 2013).

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[1] Car manufacturers like Volkswagen, Daimler and BMW already joined in by developing their own electric car sharing systems. BMW's project DriveNow for instance is to be found in Düsseldorf, Berlin and Munich.
[2] For further discussion on the distinction between "in vitro" and "in vivo", see Callon and Muniesa, 2003.

Amongst the many aspects those studies present us with, three elements are worth considering for our description of the Renault project. The first element is the *ontological work* the experiments produce (Muniesa and Callon, 2007; Millo and Leunza, 2006; Callon, 2012). Experimenting is more than just a period dedicated to preparing and describing reality, it is also a time of creation, transformation and formulation of the entities making up the world. Experimenting cannot be reduced to representation and testing because it produces material and cognitive beings, ranks and classifies them before launching them into the world. As Muniesa and Callon (2007) put it: *"experimental objects are observed and produced at the same time - produced to be observed and vice versa"* (p.163). In this sense, experimenting is more than just experimental testing or hypothesis testing in monitored conditions, it is a way to formalise and provoke reality (Lezaun, Muniesa and Vikkels, 2013). The second element is the *demonstrative* (Barry, 1999) and *participatory* (Marres, 2012) nature of those experiments. As well as being validation operations of objects in the public space, especially through transposition into words and publicisation, experiments can move what we mean by politics, thereby emotionally and effectively involving the target audience into the experimental schemes. Marres's analysis of smart home appliances (2012), for instance, states how those devices in the way they interact with people act as political and civic mediators. Finally, the hybrid nature of "open" experimental operations, in the sense that they mix various skills and socio-material entities (Latour, 1993), are a third interest for us. Evans and Karvonen's empirical study (2011) especially stresses the importance of this aspect and introduces the concept of "urban laboratory" to analyse the development of the *Greening Manchester* project. The authors tackle the negotiations for the installation of monitoring equipment designed to measure carbon dioxide emissions in real time. They describe it as a particular type of "experimental governance", especially because of its hybrid nature created by all the parties involved (university scholars, municipalities, companies, owners, citizens, etc.) and by the ability of the experiment to create a link between various knowledges intertwining multiple worlds. They state that the *"urban laboratories offer an attractive mode of governance promoting knowledge and innovation"* (p. 26) and maintain that the success or failure of a city in its struggle against "climate change" depends on its ability to operationalize, on the scale of urban politics, controlled experiments demonstrating hybrid knowledge.

This paper builds on these arguments, in order to focus on what we consider a quite poorly documented aspect of the STS debate on experimenting, namely the definition and redefinition of the geographical, organisational, social and technical boundaries that define the perimeter of the experiment. By analysing the recompositions of the perimeter of the experiment, the Twizy Way project will allow us to display the work needed to define the separation between public and private spaces on the one hand, and the distinction between goods and services on the other hand. We contend that this further develop the existing literature on experimenting, and, perhaps more importantly, bring to the fore the performative effects on the experimental mode of industrial innovation on both industrial strategy and public policies.

The main focus of this article will thus be to get a full grasp of the Twizy Way experiment by analysing it, not as data, but as a layout that needs to go through a large phase of *boundary work*. Therefore, we will not consider the concept of experiment as a rigid label unrelated to

stakeholders but rather as an element they find themselves confronted with, and that requires constant work to retain organisation and steadiness inside/outside the experimental scheme. We do not plan on using definition for any social, technical, economic, ecological, urban or political element involved in the experiment and will consider them, on the contrary, as the temporary and negotiated result of this very operation of *laboratorisation*. Similarly, the boundaries of the experiment will not be regarded as the starting point of the restitution because they precisely are the result of various articulation, frameworking and demonstration operations performed within the experiment.

That is why we will speak of a form of "flexible laboratorisation" affected by doubt and constant reorganisation of the elements making up, overflowing and interfering with the experiment. The Twizy Way experiment takes place in an experimental setting where the constitutive elements refuse to be enrolled or tamed, thereby producing a type of ever-changing, random, open and temporary laboratorisation. The flexible laboratorisation puts two separations to the test: separation of private and public interests on the one hand, and separation of goods and services markets on the other.

Our study relies on semi-structured interviews conducted between April and August 2013 with Renault's officials in charge of designing the Twizy Way project and people from Saint-Quentin-en-Yvelines who participated in this experiment. At the same time, we carried out ethnographic observations: we spent four whole days observing the daily job of the "jockeys" (the people in charge of delivering and maintaining the cars), of a supervisory officer (in charge of supervising the experiment) as well as a member of the shop staff (the place where people can register and be shown how the experiment works). This constant monitoring of the fieldwork as part of maintaining the experimental protocols will enable us to demonstrate the fragile and uncertain nature of the experiment and show the redefinitions of its boundaries

1. The experiment perimeter

In 2009, the department for innovation at Renault gave birth to the idea of developing an electric car sharing system when the executive committee decided to fund a pilot study about micro mobility. The department for New Mobilities was entrusted with the project and tasked to bring to life the company's industrial aspirations. In 2011, after collecting data from comparative studies of other European car sharing systems (DriveNow in Germany, Car2go in Ulm, etc.), Renault came up with a global strategy for an electric car-sharing project (then called "Twizz and go"). This was how the project manager described the purpose of the experiment at the time: *"The general purpose is to put the electric car market and its challenges to the test and to get an insider's view on the project"*. (Interview with the project manager of Twizy Way). That required a "testing and experimenting phase followed by a replication and marketing phase of the project". Testing and observing how the infrastructure operated from the inside was to start on 21 June 2012. On this given day, the project was supposed to be fully working thanks to a first experiment conducted with carefully selected beta testers. In September 2012, once the testing phase with "beta users" was over, the service was to be opened to the public and go on the "real life" testing phase.

Figure 1 : Twizy Way website

Four components define the perimeter of the experiment. They are: a) the geographical site, b) the distribution of the charging terminals, c) the setting up of fixed stations and d) the type of vehicle available for car sharing. These closely connected elements configure the sociotechnical architecture of the experiment: they define the scenery of the sites (distinguishing features of the towns), the organisation outline of the service (distribution of cars and stations) and the suitable technologies (type and features of the vehicle). In other words, those components define the different types of boundaries of the experiment: urban boundaries (why choose this town over another), organisational boundaries (why choose terminals and closed stations over opened ones) and technological boundaries (why choose this particular kind of vehicle over another). This paper will now successively examine each of those four components and illustrate their redefinitions over the course of the project.

2. Negotiating the urban boundaries of the experiment

The use of vehicles depends on available charging infrastructures. The experiment conducted with Twizy Way therefore had to take place in towns where electrical infrastructures would allow users to charge the cars. These charging terminals would have to be opened to all and easy to reach in order to ensure proper functioning of the service. Bearing that in mind, the heads of the project first considered ten cities, amongst which major towns like Bordeaux, Montpellier and Barcelona, to provide the Renault's project with

maximum visibility. However, as the operational phase drew closer, the budget had to be modified. Saint-Quentin was the only test city remaining. Moreover, the fact that the bigger the testing sites, the harder and riskier it is to control the experiment was one of the main arguments in favour of this choice. Here is the explanation given by one of the managers:

> *This is what the project is all about, ten cities. Yet, as it's a really risky project, we don't know if it's going to work out, we don't know what's going to happen, we're going to Saint-Quentin, we design a strategy for 10 cities and in Saint-Quentin we can only do the bare minimum. And this bare minimum will apply to all ten cities. I mean, what happens in Saint-Quentin will apply to the other cities but what we don't need in Saint-Quentin won't be tested... So, yes, we know the system will work in Bordeaux because it was designed to apply to ten different cities at the same time, ten different fares, ten different this, ten different that... That's how it was designed.* (Interview with manager of information system of Twizy Way project)

The multiple-city test was postponed to a potential second phase. Consequently, the experiment was to be carried out on a single pilot site, the different factors being adapted to this particular area for the pilot experiment to succeed, nevertheless bearing in mind the "global strategy":

> *Once the global strategy was developed, this is what happened: "now, in Saint-Quentin, we get rid of everything we don't need for Saint-Quentin", but part of a global strategy. I mean, we have the global strategy of the experiment; we wanted it to be modular and incremental so it could apply to something smaller, as small as it can get actually for Saint-Quentin. So we didn't think about replication, we thought about the bigger picture. This reminds of replication in a way.* (Interview with manager of information system of Twizy Way project)

The concept of global strategy applied to a "modular" experiment is worth examining. The test carried out in Saint-Quentin is part of a global development strategy of electric vehicle use which is not so much an experiment that will be replicated as an attempt to teach the public how to use the system.

In this respect, choosing Saint-Quentin as the only testing site facilitated monitoring and control. Not only is it the home of the Technocentre Renault, it has also shown a genuine interest in these types of experiment over the years[3]. The project manager pointed out that:

> *The city of Saint-Quentin filled all the requirements; it's a planned city, so... The company agreed to conduct a pilot experiment close by so we had the engineers and the people who worked on it at hand.* (Interview with the project manager of Twizy Way)

Mentioning the "planned city" nature of Saint-Quentin-en-Yvelines is quite significant. The creation of Saint-Quentin-en-Yvelines's "communauté de communes" (federation of municipalities) was ordered in the 1960s by the French state eager to set up a "planned city" south of Paris. Since the "communauté d'agglomération" (conurbation community) was created, Saint-Quentin's urban space has been affected by major public measures causing a demographic and economic boom in the area.

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[3] Renault had already tested an electric car-sharing service in Saint-Quentin in the late 1990s.

When Renault's "new mobilities" team presented the local authorities with the project, they had considered dividing the labour between the company and the public authority which would make Twizy Way a private initiative affecting the public space development conducted by the local government. The project planned on distributing 400 vehicles across Saint-Quentin's seven municipalities and Versailles. Those vehicles were to be found in stations especially designed for the system along with a network of charging terminals and closed stations. Renault requested the municipalities to provide public space and help to implement the transportation system hence creating, in the designated area, a private service that would benefit the public good. The original contract stated that Renault would pay the city of Saint-Quentin a fee for using public space for one year. The company thought the local authorities would pay for the installation of the charging terminals network on the testing site.

By dividing responsibilities as such, Renault contributed to an urban planning policy dedicated to developing the infrastructure for electric car sharing (terminals and stations). However, during the negotiation process, Renault decided to reduce the perimeter of experimentation. The Saint-Quentin's officials refused to spend public money on the installation of charging terminals and closed stations on the public space.

Figure 2: Twizy Way service area (marked by a green line).

Renault had to redefine the boundaries of the experiment site. Following this, the fleet was reduced to 50 cars distributed across three municipalities: Montigny-le-Bretonneux, Voisins-le-Bretonneux, Guyancourt and Trappes (only a few streets). Those new circumstances definitely modified the scale, significance and visibility of the project.

3. Charging terminals

The experiment was supposed to take place in an area featuring charging terminals enabling the users to charge the batteries of the vehicles by themselves once they were done using them. Unfortunately for Renault, Saint-Quentin's authorities refused to install electric terminals just for the test, especially if they were only to be used on the Twizy Way project. The above-mentioned manager provided us with this explanation:

> *They wanted us to put terminals on each station. But without a "délégation de service public"* (public service delegation agreement)*, it's really complicated for us, a private company, to install terminals. It's virtually impossible. The terminals would have to be available to all, etc.* (Interview with a member of Directorate Transport of Saint-Quentin)

The local government rejected the possibility to build an electric infrastructure without a "délégation de service public"[4]. Because it was on the contrary a privately conducted experiment that Renault entirely managed and funded, public authorities were not interested in paying for the charging terminals needed for the company's project. With the local authorities refusing to assume the role they were given, Renault was faced with a funding problem as the company thought they would split the costs with the local authorities. That issue redefined the nature of the test itself. As a matter of fact, one of the elements that was supposed to be tested – namely the part where the users would themselves charge the cars thanks to terminals distributed across town – was excluded from the project. However, the redefinition of the boundaries of the experiment eventually turned Twizy Way into a test to assess the degree to which local governments are involved in a project, something the company took at first for granted. Here is the explanation we were given concerning the reluctance shown by the local government and the redefinition of the experiment scope:

> *Actually, we signed a one-year agreement, so they asked us to pay for the terminals. (...) As we didn't want to deploy the terminals right away, we told Renault: "here's the solution, send your jockeys, and if it turns out well, if the experiment works, we'll consider setting up the terminals", yet with a long-term prospect in mind.* (Interview with one of membership of Directorate Transport of Saint-Quentin)

Rather than using charging terminals, the Twizy Way project ended up resorting to *jockeys*, i.e. people in charge of charging the cars and moving them around. As we will see later on, including *jockeys* in the project redefined the experiment on another level: the organisation of the service within the stations.

4. Stations and customer journey.

The Twizy Way project had been designed to test the various uses of a car sharing service. That was a brand new experiment for the company because it tackled the different relations between a user and a car sharing service rather than between a customer and an individual vehicle. To achieve this, Renault's engineers designed what they called a "customer journey" based on the implementation of closed stations where users can return and charge the cars.

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[4] Legal form by which public authorities entrust a private entity with the management of a public service they are usually in charge of.

This test was supposed to monitor a "flexible use" opposed to what the project managers called a "closed loop":

> We started working on what the customer journey could be and we came up with a first pattern (...) if Twizy had stations, users would take a vehicle from one station and return it to another. But that's the same as Velib' and Autolib' systems, isn't it? So that was the first pattern, because we knew we absolutely didn't want to use a closed loop. Here's how a closed loop works: "I take a vehicle from a station, I drive where I need to and make the journey back". That's car sharing for long-distance trips, it's short-time renting, use the vehicle for five or six hours, drive for 50/60 km. Twizy doesn't work that way, that's irrelevant. Nobody's going to take a Twizy to go, let's say, to Le Mans, do you know what I mean? It doesn't make any sense to take a car from one place to go to the cinema and then having to return it to the same spot, it won't happen. Commuting is: going to the gym, to the cinema, to work, etc. That's a spot to spot travel mode. As long as trips take place in urban/periurban areas, we need an open loop. (Interview with manager of information system of Twizy Way project)

Choosing an open loop meant a drastic redefinition of the nature of the company's offer: rather than offering an economic good users can make their own (even for a short period of time) like an individual car, they would market a service (finding an available vehicle and dropping it off wherever you want). The experiment eventually aimed at putting another aspect of the manufacturer's industrial offer to the test. Modelled on other vehicle sharing systems, like Vélib' (Paris's bike sharing service), the project tried and retained an original economic model.[5]

The observation of the Vélib' system also enabled Renault's team to anticipate a certain level of vandalism. The high level of vandalism affecting the bike sharing system in Paris (Vélib') accounted for the choice to develop a network of closed stations only opened to registered users. It was a way to create a truly self-service and self-sufficient system without resorting to people in charge of charging or monitoring vehicles.

Closed stations also had another purpose: the 'visibilisation' of Twizy Way. One of the project managers mentioned that "*a station reading Twizy Way in large letters that everyone notices, that's the point*". To choose the best possible kind of stations for the scheme, Renault held an architecture competition. After settling on a few station models, the New Mobilities team began negotiating with Saint-Quentin's authorities with the help of visual simulations of the station network across town, offering various geographical locations based on the study of commuting routes.

Yet, even though stations had been carefully designed, Renault and Saint-Quentin's authorities viewed this pilot experiment relying on stations as an impediment more than an opportunity. First of all, Renault expected the municipalities to fund the installation of the stations, just like they thought they would for the charging terminals. Without the participation of the municipality, costs became too high for the company, abandoning finally the project of making closed stations.

This is how the city's official we contacted explained the situation:

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[5] Vélib' was implemented by J.C. Decaux, a communication company known for street furniture advertising.

Installing the stations was costly, 200,000 Euros per station I believe. We were totally taken aback yet they hoped that the local government, that we, would pay for them. We said: "well, first of all, we never agreed to have this kind of thing set up, so spending 200,000 Euros for something we never wished for, it's not going to be easy let me tell you. (Interview with a member of Directorate Transport of Saint-Quentin)

Not knowing how the experiment would turn out, or whether it would last or how users would welcome it, the local government hoped to reduce the scope of the experiment, especially when it came to the type of instruments used.

So we told them: "here's what we should do, go for a simple kind of test without so many constraints. Then we'll let you conduct the experiment." As far as we're concerned, we chose to keep in line with the Grenelle 2 Act concerning car sharing: we can provide some public space or do other little things like that, it's allowed, but we don't want to do anything else anyway, (...) we hid behind the law and said: "we're not allowed to give you 200,000 Euros just like that, to pay for a station. (Interview with a member of Directorate Transport of Saint-Quentin)

As it happened with the charging terminals, redefining the scope of the experiment lead to questioning the division of responsibilities (and of financial investments) between the company and the local governments, giving up on certain aspects (installing stations) and incorporating new components into the experiment, in this case the "light" use of public space.
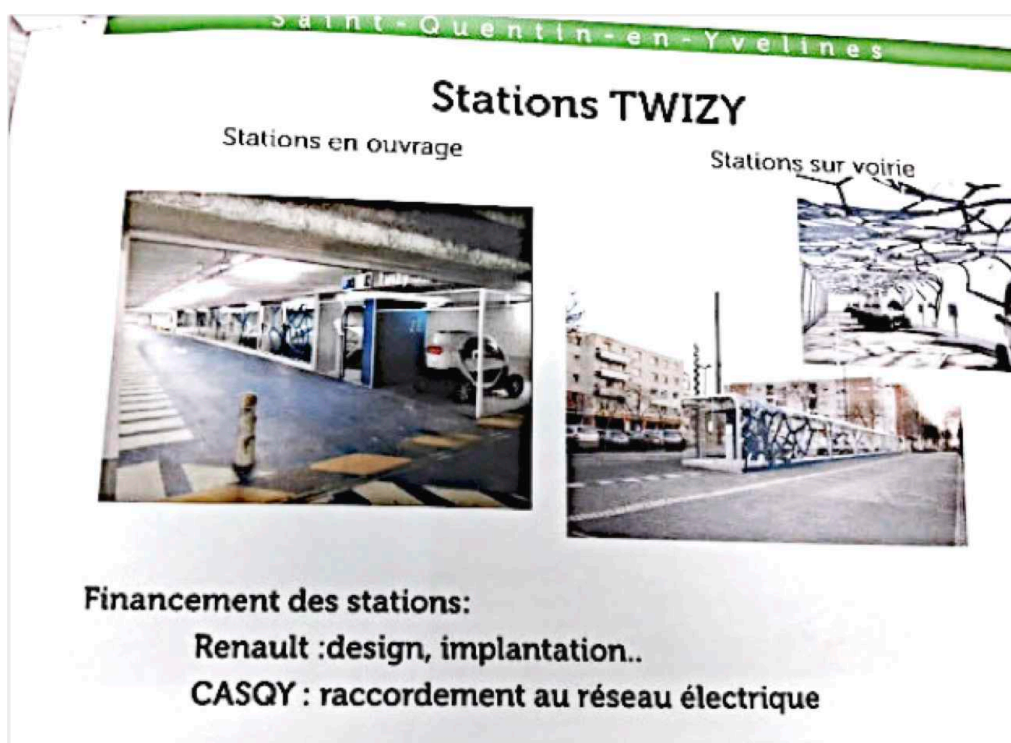
Figure 3: Twizy Way station prototype presented to the urban agglomeration of Saint-Quentin

The outcome of the discussion with the local authorities and the transformations that followed turned out to be a financial negotiation. But it also dealt with the nature of public space and the possibilities of private action upon it.

Many studies were conducted concerning the location of stations and whether we should let the vehicles enter from the front or from the back so it would take up as little

space as possible. It was really time consuming and we tried and explained Renault that was the best possible option but they needed to secure their system... We (...) tried and made them understand (...): "do you realise what it means to use public space, you need to find some room, it doesn't grow on trees... (Interview with a member of Directorate Transport of Saint-Quentin)

Experimenting on deploying stations had to be given up. Once the stations were removed from the experiment, Renault had to modify the meaning of "customer journey" and design a brand new one without charging terminals and without any stations where to pick up/return a vehicle and interact with the system.

Removing charging terminals and closed stations therefore drastically redefined the Twizy Way project. Thanks to an infrastructure test assessing the behaviour of users responsible for charging cars and going from one station to another, Twizy Way tried out the distribution of vehicles that were not attached to a station but relocated by *jockeys* employed by the company according to the needs for charging and geographical balance. Removing stations from the system meant that the company then had to develop new tracking devices for users to locate vehicles. As Renault could not develop stations, it had to design a customer journey based on smartphone applications that locate and book cars in the user's area. With a "no-station customer journey", users can register on the Internet or in the shop located next to Saint-Quentin's train station where they are given a badge. After locating a vehicle available on the map (on the Internet or with the smartphone app), the user can unlock the car parked on the street with his/her phone or badge. Not using stations eventually led to experimenting a new sharing system, that could potentially be replicated but was not originally envisioned by the company, and new types of service at first unfamiliar to the manufacturer. Redefining the spatial boundaries of the experiment matched the redefinition of the boundary between product and service that Renault put to the test, a subject developed in the following part.

5. An open vehicle

As mentioned earlier, the main reason Renault's engineers designed closed stations as part of this car sharing system was because they needed to protect the vehicle used for the experiment. To carry out this car sharing experiment, Renault selected the Twizy model, an electric vehicle launched in 2009 to promote its new range. This decision relied on the fact that electric vehicle and car sharing usually go hand in hand when it comes to commuting trips. In the meantime, the Twizy model had been specially designed for a young and modern audience with a fun appearance combining the features of both scooter and car. Amongst Renault electric car range, the Twizy model stood out as the best possible option for this type of car sharing system because it could easily be modified in order to be shared, while also being easily recognizable and thereby participating in a demonstration objective.

An electric vehicle like the Twizy is perfectly suited to car sharing because it's all about short and frequent trips where you can stop and charge batteries. It's a very good match. So that's it: a new mobilities strategy; an electric vehicle strategy; then add a really unusual vehicle, which is a plus and goes along well with commuting... it's a weird, distinctive and specific kind of vehicle. (Interview with the project manager of Twizy Way)

For Renault, the Twizy model seemed to be a real opportunity to explore the realm of car sharing with a 60 to 80 km range and a 3.30 hour full charging time. Yet, the manufacturer was well aware that, in order to get in on the electric car sharing market, it would have to produce the technical equipment required for the service. Although the company's force lay not in the size of the service area, the technological aspect could definitely make a drastic difference regarding car fleet management. Adapting the Twizy car to a sharing system

Figure 4: Twizy vehicle

caused three structuring transformations. First was the development of a "car-sharing box" i.e. an electronic device designed to access the vehicle data and make it shareable. That car-sharing box was one of the major elements of Renault's innovation as it enables shared access to a vehicle thanks to a PIN code and a smartphone, as well as *user traceability* and *vehicle location*. The box collects the vehicle data, sends it to the control centre and then processes it. The second novel element is the badge reader which identifies the user when he/she picks up a car. And the third and last element is the key, which switches the car on and off. Beyond those three main elements of the Twizy Way project, engineers developed vital add-ons to the service: a GPS and GPRS antenna to reach the call centre from the passenger compartment and a human-machine interface the customer can use to update the status of a vehicle (e.g.: to notify a temporary stop or the end of a rental period).

Furthermore, one of the main features of the Twizy model is its open nature. Having no doors nor windows and being very much exposed to bad weather could have proved counterproductive for a vehicle supposed to be available to the public 24 hours a day and without any stations to protect it. Consequently, in order to turn it into a shareable car, no screens or other sorts of fragile equipment were put in the passenger compartment. Only vital and sturdy components were considered. Here is the explanation given by one of the project stakeholders:

> *Twizy is an open vehicle which means rain can enter it as well as people because it's not closed, it has no key and isn't waterproof. So we had a problem there. We couldn't put a fragile screen in. We thought: "we're not going to put anything in there that's going to be broken or damaged, nothing too delicate." Well, the car needed to be empty, with nothing for people to see. And that's the specificity of Twizy.* (Interview with manager of information system of Twizy Way project)

Saint-Quentin's authorities did not have much to say about the Twizy model's features and Renault's thorough knowledge of the product. Yet they asked for doors to be fitted on the cars arguing that some skirt-wearing women would be reluctant to use a doorless vehicle.

They also asked for windows to protect users from the cold. In other words, the local government focused on fitting the car with functional elements (doors and windows) which had not been included in the project at first to preserve a youthful and different mobility spirit. Our contact from Saint-Quentin told us:

> *We told them that it was impossible for the vehicle to work without doors... At one point they would need to be fitted in. That was part of the elements we discussed and that they ended up integrating in the project. After long talks, they realised they were in the public space and that they had to, well, you know... Then, windows were not an option. I do think it's a major limitation of the project.* (Interview with a member of Directorate Transport of Saint-Quentin)

At the end of the day, redefining the vehicle put to the test has once more to do with public space. The issue here is to delimit the private space the car builds once in use, and the use of private data by the company in order to trace the circulation of its vehicles, and potentially the types of use of the service it puts to test.

6. A drastically redefined experiment

All the changes described above deeply redefined the manufacturer's experimental project. As seen earlier, some elements of the project had been defined (cities, stations, charging terminals, customer journey, etc.) and had to be put to the test to assess their behaviour, their resilience and their ability to be integrated in the scheme. Nevertheless, those vital elements of Renault's experimental model were faced with political, economic and urban hardship making the "laboratorisation" of these components impossible. In practice, some entities were ruled out of the experiment whereas other unexpected ones had to be integrated into the experimental process. The elements Renault wanted to assess and validate through the Twizy Way experiment could not all be tested because the experimental setting turned out to be different from the original one.

Redefining the boundaries of the project lead Renault's engineers to address the main question concerning what they call the representation levels of the experiment. The project business plan had to be re-tailored and reshaped to fit the special features of the testing site. Project managers then had to assess whether this experiment was relevant and potentially replicable. Indeed, redefining the experiment called for a new identification of elements possibly possessing a "representative" value or eligible for replication. This is how one of the project managers put it:

> *Our experiment isn't totally representative. It's a little bit of the customer journey; well, a tiny bit, because it modifies the customer journey, but not much, not mainly. And it brings up new functions, new pieces of the process and eliminates others. It surely underlines the jockeys' work, jockeys who charge the cars, if it wasn't for that, there wouldn't be any jockeys so those processes would disappear. Well, this experiment isn't a hundred percent representative of our development. Yet we considered it was representative enough to collect a big load of information on a potential deployment, but not a hundred percent. (Interview with manager of information system of Twizy Way project)*

When the engineer mentions that *"the experiment isn't a hundred percent representative"*, it means that every single element of the project could not be laboratorised because the boundaries, the participating entities and goals of the process had been modified. During the operationalisation process of the Twizy Way "laboratory" in Saint-Quentin, some entities were excluded from the geographical testing area, whereas others were included, therefore problematising what the experiment was aiming to show and describe. Because of the lack of stations and charging terminals, project managers had to introduce *jockeys* and consequently opened a new field of skills and practices that the simulation project had not planned for. On the other hand, the experiment in Saint-Quentin did not turn out to be "valid" or "representative" regarding a customer journey based on public charging terminals. The idea of "smart users" responsible for charging the vehicles could not be observed thus living aside one of the main elements of *smart mobility* Renault was eager to explore.

Conclusion

In September 2013, Renault's Twizy Way experiment was put to an end. The infrastructure was sold to Keymoov, a computing SME from Saint-Quentin, which had been developing some elements of the system with Renault. The press released then stated that:

> *In the light of this one-year experiment and of the experience gathered along the way, Renault developed its "car sharing pre-equipment" for Twizy and ZOE, specially designed for businesses. The pre-equipment allows for easy integration of a car-sharing operator's information system into the vehicle, thanks to direct access to the needed data to manage the service. Consequently, these models from the Renault Z.E. range will naturally fit into the car-sharing fleets operated by private companies and local authorities*"[6]

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[6] "Renault calls on Keymoov to operate the Twizy Way car-sharing service in Saint-Quentin en Yvelines", Press release, 24 September 2013.

According to Twizy Way project managers and regarding elements related to the operation of the vehicles (battery, mechanics, box, etc.), technical questions about the car sharing box, urban conditions and social acceptance of the system, the experiment proves to be "representative". Following the above description, it is obvious that the industrial test conducted with Twizy Way is an experiment whose perimeter is also put to the test. In this case, the industrial innovation undergoes a field test: trying to recreate the conditions of the test in a contained environment (by turning Saint-Quentin into an electric mobility "laboratory") cannot prevent the boundaries of the experiment from being deeply redefined. The experimental model of industrial innovation leads here to questioning two types of separations: the division of responsibilities between private stakeholders and public authorities on the one hand and the separation between the marketing of a product or a service on the other.

Redefining experimental components partially means redefining public space. Several matters were the subject of long debates between the company and the local authorities: the spatial extent of Renault's project on public space, the transfer to local authorities of the funding scheme for charging terminals, the "public" nature of a shared transportation system implemented by a private company and the extent to which cars should become a private space (either as a collector of individual data or as a material space for individual use). At stake here are the distribution of experimental costs and benefits, as well as the definition of the parts the local government and the private company play in the development of public space –public space as a geographical area which cannot be privatised as well as public space as a metaphorical area determined by the development of public good.

On the other hand, redefining experimental components means redefining the markets the company is interested in. By trying out a "customer journey" rather than a vehicle, the manufacturer can test both a product (a car) and a service (a car sharing system). Ultimately, the company will use the Twizy Way experiment as a first step to developing an electronic infrastructure capable of sharing and tracking vehicles.

If the success of a technical innovation depends on its ability to simplify and structure a series of heterogeneous items (Callon, 1981), then, it is clear that the Twizy Way experiment failed, in the design phase, to bring together the essential elements that would have made the test "actually representative". The experiment identified the elements needed to deploy the test (densely populated cities, public charging terminals, stations, cities involved, speeches on sustainable mobility and smart city) and yet, when time came for these entities to be integrated in the experiment, they turned out to be particularly elusive and unstable.

It is those elements which enable us to describe the Twizy Way experiment in terms of "flexible laboratorisation". This concept highlights the fact that, when experimenting on developing markets or technological infrastructures, the tested and demonstrated elements do not pre-date the experimental process itself. The technical, social, urban and political factors the experiment aims at analysing are not defined nor transposed into the "world" in a perfectly circumscribed manner. They are, on the contrary, a controversial outcome of the very own formation and alignment process of the experiment.

The Twizy Way example illustrates an experimental system for industrial innovation in which the boundaries of the experiment are put to the test. The experiment does not take place in a motionless space yet this space is questioned just like any other project component. This point is particularly useful as a contribution to the study of experimental processes and their ontological effects (see Marres, 2012). But more importantly, this approach highlights the need to identify situations where redefining boundaries between private and public stakeholders and between product and service turns industrial innovation into a technical, economic and political experiment.

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